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(54) Magnetic powder and magnetic toner

Magnetpulver und magnetischer Toner

Poudre magnétique et toner magnétique

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FR-A- 2 353 619 **US-A- 3 535 245**

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resin, the image density is reduced and the background increases. From the viewpoint of the image density and back-the particle surface is not coated with these materials, due to poor dispersibility of the magnetic particles in a vehicle.

The magnetic particle powder according to the invention is coated with Si oxide. Al oxide or a mixture thereof. If

22.5 % by weight, or more preferably from 19.5 % to 22 % by weight.

From the viewpoint of clarity of the image density, the amount of Fe₂₊ should preferably be from 19.5 to 22.5 % by weight.

Higher density than that given by the conventional magnetic toners, it is sufficient if the upper limit of Fe₂₊ is 22.5 % than 18.5 % by weight, the output image has a reddish tinge which is undesirable. To obtain a deep black image of

18.5 % by weight, the amount of Fe₂₊ in the magnetic particle powder of this invention is from 18.5 to 22.5 % by weight, if it is less

magnetization of from 12 to 18.5 emu/g.

Likewise be identified, if it is greater than 20 emu/g, the magnetic particle powder should preferably have a residual cannot be identified. It is less than 12 emu/g, a suitable output is not obtained when the encoded images are to be read so that the characters

it is less than 12 emu/g, a suitable output is not obtained when the encoded images are to be read so that the characters

The residual magnetization of the magnetic particle powder according to the invention is from 12 to 20 emu/g. If

The invention is hereinafter described further in detail with referring to preferred embodiments.

As an intermediate for producing the preceding magnetic particles.

Fig. 1 hereinbelow illustrates the relation of residual magnetization of the magnetic particles as a final

product obtained by the present invention with saturation magnetization of magnetite composite particles

in the accompanying drawings.

surface area of from 3.5 to 9.5 m²/g.

The present invention therefore provides a magnetic particle powder which comprises magnetic particles coated with silicon oxide. aluminum oxide or a mixture thereof, has a residual magnetization of from 12 to 20 A₂M/kg (12 to 20 emu/g) contains 18.5 to 22.5 % by weight of Fe₂₊ based on the total weight of the powder and has a specific

enclosed information the therefore provides a magnetic particle powder which comprises magnetic particles coated

with silicon oxide. aluminum oxide or a mixture thereof, has a residual magnetization of from 12 to 20 A₂M/kg (12 to 20 emu/g) contains 18.5 to 22.5 % by weight of Fe₂₊ based on the total weight of the powder and has a specific

surface area of from 3.5 to 9.5 m²/g.

The object addressed by this invention is thus to obtain a magnetic particle powder which is to be included in the magnetic toners used for MCR so as to enable the formation of fine accurate images and the exact detection of the

encoded information the conventional acicular magnetic toner "Mapico Black".

These requirements however had not yet been produced using the conventional magnetic particle powders such as

enable the formation of fine accurate images and the exact detection of the encoded information. A toner fully satisfying

At present, there is a great need for new magnetic particle powders for the magnetic toners of MCR, which would

as acicular magnetic "Mapico Black", supplied by Cities Services Co., as described in US-A-4517268.

Conventionally, the magnetic particle powders used in MCR magnetic toners were particulate magnetites such

so as to obtain toners with the desired properties.

Improvements in the magnetic particle powders having a direct effect on the magnetic toners used to form the images

image quality with little background and as high an image density as possible. Also, the accurate reading of images

so as to obtain toners with the desired properties.

The magnetic toners used in MCR, as described hereinbelow, must therefore be capable not only of forming

ordinarily characters in the same way as toners used in the electrostatic image developers, but also of forming special

numerals or images encoded by special characters in fine detail. Furthermore, it must also be possible to read the

image quality with little background and as high an image density as possible. Also, the accurate reading of images

so as to obtain toners with the desired properties.

The magnetic toners used in MCR, as coming to be now rapidly coming into wide use.

Conventionally by laser beam printers which are now rapidly formed

which can preferentially be used in MCR, is a technique wherein encoded images to be formed

magnetic toners that would enable ordinary character images and great need has arisen in recent years for

terms of workability and economy. To resolve these problems, a great need has arisen in recent years for

as the ordinary characters and encoded characters could not be printed at the same time, serious problems arose in

planography, different inks had to be used for the ordinary character images and for the encoded images. Furthermore,

it is particularly widely used for inspecting personal checks in bank clearing houses. In conventional typography and

characters and images formed and encoded by special numerals or characters to collect and identify such ordinary

information can be read on the surface of a personal check or other document bearing images formed by ordinary

which can preferentially be used in MCR are also being carried out intensively. MCR is a technique wherein encoded

referring to as MCR, is coming to be paid attention attractively, and developmenst and research of the magnetic toners

developers such as magnetic toners and carriers. In recent years, magnetic image characteristics and latent image

powder and an organic polymer was already employed in magnetic printing materials and electrostatic recognition, latent image

or novel functions have been actively pursued. Among them, a composite material comprising a magnetic particle

researches on the complexing of different materials to provide a new composite material with high performance

recognition, which enables the formation of fine accurate images and the exact detection of encoded informations.

This invention relates to a magnetic particle powder included in magnetic toners used for magnetic image character

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D description

ground, the coating amount is preferably from 0.1 to 2.0 % by weight of the magnetite particle in terms of Al_2O_3 and/or SiO_2 .

The specific surface area of the magnetic particle powder according to the invention is from 3.5 to 9.5 m^2/g , preferably, 4.0 to 8.5 m^2/g . If it is less than 3.5 m^2/g , the dispersibility of the magnetite particles in the vehicle resin decreases and the background increases. If it is greater than 9.5 m^2/g , the electrostatic properties of the toner decline and the image density decreases.

The magnetic particle powder according to this invention are typically in the form of a polyhedron, preferably a hexahedron or octahedron, or a sphere.

The magnetic particle powder according to this invention may be prepared by heat oxidation in an oxidizing atmosphere, at 350°C to 700°C, of magnetite particles synthesized from an aqueous solution containing Fe^{2+} and coated with the Al compound, Si compound or both of these compounds, or alternatively, by preliminary heat oxidation at 200 to 350°C followed by the heat oxidation at 350 to 700°C to convert them into maghemite/hematite composite particles coated with the aforesaid oxides, and then by thermal reduction in a reducing atmosphere at 250 to 500°C of the resultant composite particles.

In the preparation described in the foregoing, the magnetite particles obtained by the wet process are in the form of hexahedron, octahedron, polyhedron or sphere, and have the specific surface area of from 4 to 10 m^2/g . In the wet process, an oxidizing gas may be passed at a temperature of from 60°C to 100°C into an aqueous solution of Fe-containing precipitate such as Fe(OH)_2 or FeCO_3 , obtained by mixing an aqueous solution of a ferrous salt such as ferrous sulfate with an aqueous solution of alkali such as sodium hydroxide or sodium carbonate, so as to give a black precipitate. Acid radicals are then washed out with water, and the product dried to prevent discoloration. In another method, an aqueous solution containing Fe^{2+} and Fe^{3+} in the ratio 1:2 is prepared using an aqueous solution of ferrous salt such as ferrous sulfate and an aqueous solution of ferric salt such as ferric sulfate, at least one equivalent of an aqueous solution of alkali such as NaOH is added, and the resulting mixture is heated to between 50° and 100°C to give a black precipitate. Acid radicals are then washed out with water, and the product dried to prevent discoloration.

In the above preparation method, the magnetite particles are coated with an Al compound, Si compound or both of these compounds. The Al compound may include aluminum sulfate, aluminum chloride, aluminum nitrate or sodium aluminate. The Si compound may include water glass, potassium silicate, sodium silicate or colloidal silica.

The magnetite particles may be soaked with an aqueous solution of the Al compound, Si compound, or both of Al and Si compounds. Alternatively, the magnetite particles may first be soaked with an aqueous solution of the Al compound, Si compound or both of Al and Si compounds, and an aqueous solution of acid or alkali added to cause deposition of Al oxide hydroxide or hydroxide, or of Si oxide hydroxide or hydroxide, on the surface of the magnetite particles. The latter method is to be preferred.

The heat oxidation temperature in this method is 350°C to 700°C. If the temperature is less than 350°C, the generation of hematite in the maghemite/hematite composite is insufficient, and only the magnetite particles having a low coercive force and residual magnetization are obtained. If the temperature is higher than 700°C, the magnetite particles having the residual magnetization in the specified range are obtained, but inter-particle sintering occurs so that the dispersibility in the vehicle resin is poorer.

In the preparation method described in the foregoing, a heat oxidation at 200°C to 350°C may, if necessary, be carried out prior to the heat oxidation at 350°C to 700°C. In this instance, it is possible to cause the magnetite particles to emit a considerable amount of heat in advance, and therefore it is easy to adjust the temperature when the starting particulate magnetite is converted to the particulate maghemite/hematite composite, to control the amount of hematite in the maghemite/hematite particles, and to control the residual magnetization of the magnetite particles.

If the temperature is less than 200°C, a considerable time is required to initiate the exothermic reaction of the magnetite particles. The sufficient heat may be emitted by the magnetite below 350°C, so there is no advantage in using higher temperatures.

The heat reduction temperature in the present invention is 250°C to 500°C. If it is less than 250°C, the reduction proceeds too slowly, and a considerable time is required to generate the magnetite particles. If it is higher than 500°C, the reduction proceeds too rapidly causing particle deformations and inter-particle sintering.

The preparation method, by which the amount of hematite in the particulate maghemite/hematite composite may be controlled, makes it possible to obtain the magnetite particles having the residual magnetization corresponding to the amount of hematite, and it is therefore easy to control the residual magnetization of the magnetite particles.

The above relation is represented in Fig. 1, of which data were derived from some experiments among many investigations conducted by the inventors. Fig. 1 shows the relation between the residual magnetization of the magnetite particles finally obtained and the amount of hematite in the maghemite/hematite composite particles. The latter composite particles were produced by the heat oxidation at 400 to 650 °C of three sorts of magnetite particles obtained from the aqueous solution, and the former magnetite particles as a final product were produced by the reduction of the latter composite particles thus obtained. The amount of hematite in the maghemite/hematite composite was expressed using measured values of the saturation magnetization of the composite. The smaller is the saturation magnetization,

EXAMPLES

The magnetic particles thus produced in accordance with the invention is used to form images, the images are finely accurate and can be read accurately. The magnetic particles of the invention can therefore be advantageously used as the magnetic powder for the magnetic toners used in MICR. As shown by comparative examples hereinbefore described, if the magnetic particles have the residual magnetization outside the specified range, contain an amount of Fe_2+ outside the specific range, have the specific surface area outside the specified range, are not coated with Si oxide, and that the surface of each particle is coated with Si oxide, the toner having the advantages of the magnetic toner according to this invention are within the specific ranges, and that the residual magnetization, amount of Fe_2+ and specific surface area are controlled to lie within the specific ranges, and that the particles include in them into the toner thus obtained is used to manufacture a magnetic toner including the toner which is used to form images, the images are finely accurate and can be read accurately. The toner thus obtained is used to manufacture a magnetic toner including the toner which is used to form images, the images are finely accurate and can be read accurately.

In Fig. 1, the lines X to Z correspond to SiO_2 containing spherical magnetic particle powder coated with 0.40% by weight of Al oxide as calculated in terms of Al_2O_3 (mean average diameter: 0.30 μm , SiO_2 content: 0.23% by weight), by weight of Al oxide as calculated in terms of Al_2O_3 (mean average diameter: 0.35 μm), and another octahedral magnetic particle powder coated with 0.34% by weight of Al oxide as calculated in terms of SiO_2 (mean average diameter: 0.28 μm), respectively.

Table 1

No.	Type of Magnetite Particle					Content of SiO ₂ (wt%)
	Shape	Average Diameter (μm)	Specific Surface area (m ² /g)	Content of Fe ²⁺ (wt%)	Residual Magnetization (emu/g)	
A	Particulate	0.31	3.5	18.2	8.5	--
B	Particulate	0.28	5.6	18.0	9.8	--
C	Particulate	0.22	7.3	17.9	10.4	--
D	Particulate	0.22	7.3	18.3	10.5	0.24
E	Particulate	0.15	8.9	15.1	13.2	0.05

Heat Treatment of Magnetite Particles Formed in the Foregoing:

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Preparation Example 1

Sodium hydroxide was added to a suspension obtained by mixing 1 kg of magnetite particle powder A with 10 l of

of Fe^{2+} , its BET specific surface area was $8.1 \text{ m}^2/\text{g}$.
 from one another. The powder had a residual magnetisation g , of 16.3 emu/g and contained 20.7% per cent by weight
 diameter of $0.28 \mu\text{m}$, the same shape as those of the starting magnetic particle, and they were distinctly separate
 Electron microscope observation showed that the particles of this resultant magnetic powder had an average
 of $5 \mu\text{m}$, while the contents of the retort were heat reduced at 320°C for 190 min to obtain a magnetic particle powder
 Thereafter, the atmosphere in the retort was replaced by N_2 , and then the flow gas was changed to H_2 at a rate
 saturation magnetization, which was found to be 10.8 emu/g .

A part of the above magnetite/hematite composite powder was taken out and subjected to a measurement of
 300°C for 60 min and then heat oxidized at 560°C for 90 min to obtain a powder of a magnetite/hematite composite.
 through every minute at a rate of $5/\text{min}$ while rotating the retort, and at the same time the particles were heated at
 manner as described in Preparation Example 2, was introduced into a 3l retort having one open end. Air was passed
 One kg of the magnetite particle powder C coated with Al oxide and Si oxide, which were produced in the same

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Preparation Example 3

of Fe^{2+} , its BET specific surface area was $8.4 \text{ m}^2/\text{g}$.
 from one another. The powder had a residual magnetisation g , of 14.5 emu/g and contained 19.8% per cent by weight
 diameter of $0.27 \mu\text{m}$, the same shape as those of the starting magnetic particle, and they were distinctly separate
 Electron microscope observation showed that the particles of this resultant magnetic powder had an average
 of $5 \mu\text{m}$ while the contents of the retort were heat reduced at 310°C for 220 min to obtain a magnetic particle powder.
 Thereafter, the atmosphere in the retort was replaced by N_2 , and then the flow gas was changed to H_2 at a rate
 saturation magnetization, which was found to be 10.5 emu/g .

A part of the above magnetite/hematite composite powder was taken out and subjected to a measurement of
 60 min and then heat oxidized at 530°C for 90 min to obtain a powder of magnetite/hematite composite.

every minute at a rate of $5/\text{min}$ while rotating the retort, and at the same time the particles were heated at 300°C for
 particles coated with SiO_2 and Al_2O_3 was introduced into a 3l retort having one open end. Air was passed through
 were respectively 0.50 per cent by weight as SiO_2 and 0.20 per cent by weight as Al_2O_3 . One kg of these magnetite
 Fluorescent X-ray spectroscopy showed that the amounts of Si and Al on the surface of the blacks particles obtained
 on their surfaces. The suspension containing this black precipitate was filtered, washed and dried.

by Al as calculated in terms of Al_2O_3 , corresponds to 0.3 per cent by weight of Al_2O_3 , with respect to the
 magnetite powder, and 10.0 g of aluminum sulfate supplied by Yonemiyama Kogyo K.K., containing 30 per cent
 weight of Si as calculated in terms of SiO_2 , corresponds to 0.5 per cent by weight of SiO_2 , with respect to the starting
 weight to adjust the pH to 9 . 17.2 g of # 3 water glass (supplied by Tokuyama Soda, Co., Ltd., containing 29 per cent by
 sodium hydroxide was added to a suspension obtained by mixing 1 kg of magnetite particle powder C with 10 l of
 water to adjust the pH to 9 .

Preparation Example 2

area was $4.1 \text{ m}^2/\text{g}$.
 a residual magnetisation g , of 13.5 emu/g , and contained 21.2% per cent by weight of Fe^{2+} . Its BET specific surface
 shape as those of the starting magnetic particle and that they were distinctly separate from one another. The powder
 Electron microscope observation showed that the particles of this resultant magnetic particle powder had the same
 while the contents of the retort were heat reduced at 340°C for 150 min to obtain a magnetic particle powder.
 Thereafter, the atmosphere in the retort was replaced by N_2 , and the flow gas was changed to 2l of H_2 gas/min
 of saturation magnetization, which was found to be $6.3.2 \text{ emu/g}$.

A part of the above magnetite/hematite composite particle powder was taken out and subjected to a measurement
 composite.

for 60 min, and were then heat oxidized at 390°C for 90 min to obtain a powder of a magnetite/hematite
 was passed through magnetite particles coated with SiO_2 was introduced into a 3l retort having one open end. Air
 One kg of these magnetite particles coated with SiO_2 was introduced into a 3l retort having one open end. Air
 was 0.25 per cent by weight as calculated in terms of SiO_2 .
 Fluorescent X-ray spectroscopy showed that the amount of SiO_2 on the surface of the black particles obtained
 deposited on their surfaces. The suspension containing this black precipitate was filtered, washed and dried.
 with respect to the starting magnetite particles, was then added thereto followed by stirring the mixture and sulfuric
 acid was added to adjust the pH to 9 . This gave a black precipitate of the magnetite particles having a SiO_2 film
 by weight of Si as calculated in terms of SiO_2 , corresponds to 0.5 per cent by weight as calculated in terms of SiO_2
 water to adjust the pH to 11 . 17.2 g of # 3 water glass (supplied by Tokuyama Soda, Co., Ltd., containing 29 per cent
 by weight of Si as calculated in terms of SiO_2 , corresponds to 0.5 per cent by weight as calculated in terms of SiO_2
 was 0.25 per cent by weight as calculated in terms of SiO_2 .

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Preparation Examples 4 - 5 and Comparative Examples 1 - 2

Magnetite particle powders were obtained in the same manner as in Preparation Example 1, excepting that the type of starting magnetite powder, type and amount of coating material, heat oxidation temperature, oxidation time, 5 reducing temperature and reducing time were varied in producing the magnetite particles. Table 2 shows the main producing conditions and properties of the products obtained.

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Table 2-1

Preparation Examples and Comparative Examples	Starting Particle Material	Coating Operation		Preparation of Particulate Maghemite/Hematite Composite			
		Coating Material	Amount (wt %)	Pre-heating Temperature (°C)	Time (min)	Oxidation Temperature (°C)	Time (min)
Preparation Ex. 1	A	#3 Water Glass	0.5	300	60	390	90
Preparation Ex. 2	C	#3 Water Glass	0.5	300	60	530	90
Preparation Rx. 3	C	#3 Water Glass	0.5	300	60	560	90
Preparation Rx. 4	B	#3 Water Glass	0.5	290	60	520	90
Preparation Rx. 5	B	#3 Water Glass	0.5	290	60	570	90
Comparative Ex. 1	D	--	--	300	60	570	90
Comparative Ex. 2	B	#3 Water Glass	0.5	290	60	600	90
		Aluminum Sulfate	0.3				

Table 2-2

Preparation Examples and Comparative Examples	Particulate Magnetite/Semacite Composite	Preparation of Particulate Magnetite powder						Particulate Magnetite powder			
		Reduction Saturation	Reduction Time	Average Diameter	Specific Surface Area	Content of Fe ²⁺ (wt%)	Residual Magnetization (emu/g)	Coated amount of Si or Al Oxide (wt%)			
	(emu/g)	(min)	(μm)	(m ² /g)							
Preparation Ex. 1	63.2	340	150	0.39	4.1	21.2	13.5	0.25			
Preparation Ex. 2	21.5	310	220	0.27	8.4	19.0	14.5	0.50			
Preparation Ex. 3	10.0	320	190	0.20	8.1	20.7	16.3	0.20			
Preparation Ex. 4	6.5	360	150	0.34	6.4	22.1	18.0	0.50			
Preparation Ex. 5	2.2	340	140	0.36	6.1	22.2	19.7	0.51			
Comparative Ex. 1	10.2	340	150	0.31	7.5	21.0	15.5	--			
Comparative Ex. 2	1.7	320	180	0.36	6.0	20.4	20.5	0.51			

Manufacture of Magnetic Toner:

Example 6

70 parts by weight of the magnetite particle powder obtained in Preparation Example 4, 100 parts by weight of styrene acrylic resin, 0.5 parts by weight of a negative charge control agent and 3 parts by weight of low molecular

Negatively chargeable magnetic developers were prepared in the same manner as in Example 6 excepting that the type of magnetic powder was varied. Images were formed using these negatively chargeable magnetic developer in the same way as in Example 6. Table 3 shows the image properties and MICR characteristics.

The magnetic particle used in Example 13 was Mapico Black supplied by Cities Services, Co., and the acicular magnetic particle powder F used in Example 15 was a product of MTA-740 supplied by Toda Corp. (long axis: 0.4 μm , aspect ratio (long axis:short axis) = 6.7, specific surface area: 1.9 m^2/g , amount of Fe_2+ : 14.0 percent by weight, residual magnetization: 31.4 emu/g, amount of Si on the surface: 0.33 percent by weight as SiO_2).

Example 7 - 15

weight polypropylene were mixed together in a mixer at 140°C for 15 minutes, cooled, coarsely crushed and then finely ground. This finely ground substance was then classified pneumatically to give a magnetic toner, to which colloidal silica was added so as to obtain a negatively chargeable magnetic developer.

This developer was introduced into a Hewlett Packard Laser Jet Printer III, and used to form an image. The image was black with high density and very low background, and the fixability was excellent. MICR output was also satisfactory, and reliability of reading images was adequate.

Table 3-1

Example	Magnetite Particle		Image quality			MICR Characteristics		
	Type	Content of Magnetite (Parts by weight)	fixed-ness	Color	Image density	Back-ground	Output	Reliability
Ex. 1 Preparation Example 4		70	5	Black	5	5	3	3
Ex. 2 Preparation Example 5		70	5	Black	5	5	5	5
Ex. 3 Preparation Example 3		85	5	Black	5	5	5	5
Ex. 4 Preparation Example 2		105	4	Black	4	5	5	5
Ex. 5 Preparation Example 1		125	4	Black	3	4	4	4
Ex. 6 Comparative Example 1		105	4	Black	4	2	4	2
Ex. 7 Comparative Example 2		70	5	Black	5	5	2 (Excessive)	2

Evaluation: Each number is scored in line with the following criteria:

1. Fairly bad
2. Bad
3. Acceptable
4. Good
- 5.. Fairly good

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Table 3-2

Example	Magnetite particle		Image quality			MICR Characteristics		
	Type	Content of Magnetite (parts by weight)	Fixed-ness	Color	Image Density	Back-ground.	Output	Reliability
Ex. 8	Particle	Magnetite S.	125	3	reddish black	3	5	[In)sufficient]
Ex. 9	Particle	Magnetite S.	155	3	slightly reddish black	3	5	[In)sufficient]
Ex. 10	Recliner	Magnetite F	45	3	reddish black	2	2	1

Evaluation: Each number is scored 1 line with the following criteria:
1. Fairly bad
2. Bad
3. Acceptable
4. Good
5. Fairly good

Claims

1. A magnetic particle powder which comprises magnetite particles coated with silicon oxide, aluminium oxide or a mixture thereof, has a residual magnetisation of from 12 to 20 Am²/kg (12 to 20 emu/g), contains from 18.5 to 22.5 % by weight of Fe²⁺ based on the total weight of the powder and has a specific surface area of from 3.5 to 9.5 m²/g.
2. A powder according to claim 1, wherein the residual magnetization is from 12 to 18.5 Am²/kg (12 to 18.5 emu/g).
3. A powder according to claim 1 or 2, wherein the content of Fe²⁺ is from 19.5 to 22.5 % by weight.
4. A powder according to claim 3, wherein the content of Fe²⁺ is from 19.5 to 22 % by weight.
5. A powder according to any one of the preceding claims, wherein the coating amount of Si and/or Al oxide is from 0.1 to 2.0 % by weight based on the total weight of the powder.
- 10 6. A powder according to any one of the preceding claims, wherein the specific surface area is from 4.0 to 8.5 m²/g.
7. A powder according to any one of the preceding claims, wherein each particle is in the form of a polyhedron or sphere.
- 15 8. A powder according to any one of the preceding claims, wherein the polyhedron is a hexahedron or octahedron.
9. A magnetic toner for use in magnetic image character recognition incorporating a magnetic particle powder as defined in any one of the preceding claims.

Patentansprüche

1. Pulver aus magnetischen Teilchen, welches Magnetitteilchen enthält, die mit Siliciumoxid, Aluminiumoxid oder einem Gemisch davon beschichtet sind, wobei das Pulver eine Restmagnetisierung von 12 bis 20 Am²/kg (12 bis 20 emu/g) besitzt, 18,5 bis 22,5 Gew.-% Fe²⁺, bezogen auf das Gesamtgewicht des Pulvers, enthält und eine spezifische Oberfläche von 3,5 bis 9,5 m²/g aufweist.
2. Pulver gemäß Anspruch 1, wobei die Restmagnetisierung 12 bis 18,5 Am²/kg (12 bis 18,5 emu/g) beträgt.
3. Pulver gemäß Anspruch 1 oder 2, wobei der Gehalt an Fe²⁺ 19,5 bis 22,5 Gew.-% beträgt.
4. Pulver gemäß Anspruch 3, wobei der Gehalt an Fe²⁺ 19,5 bis 22 Gew.-% beträgt.
5. Pulver gemäß einem der vorstehenden Ansprüche, wobei die Menge an Silicium- und/oder Aluminiumoxid in der Beschichtung 0,1 bis 2,0 Gew.-%, bezogen auf das Gesamtgewicht des Pulvers, beträgt.
- 40 6. Pulver gemäß einem der vorstehenden Ansprüche, wobei die spezifische Oberfläche 4,0 bis 8,5 m²/g beträgt.
7. Pulver gemäß einem der vorstehenden Ansprüche, wobei jedes Teilchen die Form eines Polyeders oder einer Kugel aufweist.
8. Pulver gemäß einem der vorstehenden Ansprüche, wobei das Polyeder ein Hexaeder oder ein Octaeder ist.
- 45 9. Magnetischer Toner zur Verwendung bei der Erkennung von magnetischen Bildzeichen, wobei der Toner Pulver aus magnetischen Teilchen, wie in einem der vorstehenden Ansprüche definiert, enthält.

Ré vindications

1. Poudre de particules magnétiques, qui comprend des particules de magnétite revêtues d'oxyde de silicium, d'oxyde d'aluminium ou d'un de leurs mélanges, possède une magnétisation ou aimantation résiduelle de 12 à 20 Am²/kg (12 à 20 emu/g), contient de 18,5 à 22,5 % en poids de Fe²⁺, sur la base du poids total de la poudre, et a une

"Toner" (encre solide) magnétique destiné à servir dans une reconnaissance de caractères d'image magnétique.

9. "Toner" (encre solide) magnétique destiné à servir dans une reconnaissance de caractères d'image magnétique, cette encre solide ou toner incorporant une poudre de particules magnétiques selon la définition indiquée dans une quelconque des revendications précédentes.

8. Poudre selon l'une quelconque des revendications précédentes, dans laquelle le polyéthyle est un hexaéthyle ou un octaéthyle.

7. Poudre selon l'une quelconque des revendications précédentes, dans laquelle chaque particule a la forme d'un polyéthyle ou d'une sphère.

6. Poudre selon l'une quelconque des revendications précédentes, dans le cas de laquelle la surface spécifique est de 4,0 à 8,5 m²/g.

5. Poudre selon l'oxyde de silicate de fer de 0,1 à 2,0 % en poids, sur la base du poids total de la poudre.

4. Poudre selon la revendication 3, dans laquelle la teneur en Fe²⁺ est de 19,5 à 22 % en poids.

3. Poudre selon la revendication 1 ou 2, dans le cas de laquelle la teneur en Fe²⁺ est de 19,5 à 22,5 % en poids.

2. Poudre selon la revendication 1, dans le cas de laquelle l'aimantation résiduelle est de 12 à 18,5 Am²/kg (12 à 18,5 emu/g).

surface spécifique de 3,5 à 9,5 m²/g.

Fig. 1



